UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

MR. W. E. THRIFT has been elected Erasmus Smith professor of natural and experimental philosophy in Trinity College, Dublin, in succession to the late Prof. G. F. Fitzgerald.

WE are glad to notice in the report of the committee of the Bristol Museum that interest in nature study is encouraged by various means. In one of the rooms of the Museum, three aquaria containing the ova of the common frog, and the common and crested newts, were arranged, in order that the various stages of development passed through by these forms might be seen by visitors. The aquaria proved of especial interest to young people from schools. Lectures have been given by Mr. H. Bolton, the curator, to the students of evening continuation schools, and the Museum has been visited by a number of classes from other schools. The committee record that definite steps have been taken to provide the additional accommodation that has long been needed. The proposal took the form of providing for museum extension in conjunction with the establishment of a municipal art gallery, and the generosity and public spirit of Sir William Henry Wills has made this possible. Upon the basis that the sum of about 30,000*l.* would be required to provide a suitable building for both purposes, Sir W. H. Wills offered that if 10,000*l.* were provided for museum extension on the site adjoining the present building, he would provide for the completion of the scheme. This munificent offer was accepted by the council, who also accepted a report of the joint libraries and museum committees recommending the requisite application to Parliament, and placing the administration of the proposed art gallery in the hands of the museum committee.

IN connection with the London School of Economics and Political Science, Lord Rosebery delivered an address on commercial education at the Mansion House on Thursday last. The Lord Mayor, in opening the proceedings, stated that the object of the school was to provide a scientific training in the structure and organisation of modern industry and commerce and the general causes and criteria of prosperity as they were illustrated or explained in the policy and the experience of the British Empire and foreign countries. Mr. Passmore Edwards had generously contributed 10,000*l.* towards the erection of a building for the faculty of economics and political science; and Lord Rothschild had given 5000*l.* In the course of his address, Lord Rosebery said: "From whatever standpoint we may regard the age, I think we must all be aware that we are coming to a time of stress and of competition for which it is necessary that we should be fully prepared. It is not necessary here to indicate what form that stress or that competition may take, but in military matters, in naval matters, in commercial matters, in educational matters, we see more clearly day by day that we shall not be allowed to rest on any reputation that we possess already, but that we shall have to fight for our own hand in every department of human activity and human industry if we wish to keep our place. It is necessary for a nation in these days to train itself by every available method to meet the stress and the competition which is before it. Lord Salisbury said the other day—and I think with some truth—that it was impossible to define technical education. Well, I do not think it is impossible, but I think it is difficult. The way in which I should define it—very imperfectly, I am aware—is this. I should define it as education having a direct practical bearing on any definite industry or calling; that is to say, an education, not as we are accustomed to see secondary education as carried out in this country—an education for the training and elevation of the mind—but a practical training having a business bearing." The United States Ambassador, in proposing a vote of thanks to the Lord Mayor, said there was no doubt that colleges of economics and of political science were the latest development in the theory and practice of that education which was to fit men for the great affairs of life as they were developing in the complex and rapidly varying phases of modern civilisation. In the United States they regarded them as among the chief means of maintaining their part in that rivalry which they were maintaining, and meant to maintain with all their force, with their sister nations of the world, and especially with this country, to which they were so much attached—a rivalry not of arms or of warfare, but a rivalry of brains, of skill, of courage in the great industries of life.

SCIENTIFIC SERIALS.

Transactions of the American Mathematical Society, vol. ii. No. 1.—Invariants of systems of linear differential equations, by E. J. Wilczynski. The author has elsewhere shown that the most general point-transformation, which converts a system of n homogeneous linear differential equations into another of the same form and order, is

$$x = f(\xi),\ y_k = \sum_{i=1}^{n} \alpha_{ki}(\xi)\eta_i \ \ldots\ (k = 1, 2, \ldots n),$$

where $f(\xi)$ and $\alpha_{ki}(\xi)$ are arbitrary functions of ξ, and the determinant $|\alpha_{ki}(\xi)|$ does not vanish identically (*American Journal of Mathematics*, January 1901). In the present paper he considers those combinations of the coefficients of a system of linear differential equations which remain invariant when the system is transformed by the above transformation. These transformations form an infinite continuous group, and the author employs Lie's theory throughout, as Dr. Bouton has done in the *American Journal of Mathematics*, vol. xxi. No. 2. The applications of the theory are but lightly touched upon, and only a passing mention is made of covariants (p. 23) in this (first) paper.—Divergent and conditionally convergent series whose product is absolutely convergent, by Florian Cajori. Tests of the convergence of the product of conditionally convergent series have been worked out by Pringsheim, A. Voss and by Cajori (see *American Journal of Mathematics*, vol. xv. and vol. xviii., and *Bulletin* of the American Mathematical Society, vol. i. (1895). Two typical examples are discussed and also the author's general method.—Sets of coincidence points on the non-singular cubics of a syzygetic sheaf, by M. B. Porter. The points where a cubic can have an eighth order contact with cubics of the syzygetic sheaf are called by Halphen coincidence points of the cubic. The author considers certain geometrical relations that subsist between an inflexion triangle and its associated group of in- and circumscribed rectilinear triangles. The number of these triangles is 24. We give one property. Each in-circumscribed triangle is in six ways perspective with its associated inflexion triangle.—Note on non-quaternion number systems, by W. M. Strong. All number systems have been divided into the quaternion and non-quaternion systems, and Scheffers has shown that the n fundamental units of a non-quaternion system may be so chosen that the multiplication table takes a particularly simple form, which is in turn characteristic of the non-quaternion systems. The present paper shows that the choice of the units may be so regulated that the multiplication table becomes still simpler.—On the reduction of the general Abelian integral, by J. C. Field, embodies results (in 38 pp.) which were presented at the annual meeting of the Society held in 1897. MM. Appell and Goursat, in their "Théorie des fonctions algébriques et de leurs Intégrales" (pp. 344–345) give a brief sketch of Hermite's method for obtaining by rational operations the reduced form for a hyperelliptic integral, in which note they make a remark which seems to imply that the more general problem in the case of the Abelian integrals was still awaiting a solution. The present paper is the author's solution of the problem.—"Ueber flächen von constanter Gausscher Krümmung," by D. Hilbert. The greater part is concerned with Flächen von negativer and the rest with Flächen von positiver constanter Krümmung (*cf.* Dini, *Annali di Mat.* Bd. 4. 1870; Darboux, "Leçons sur la théorie générale des surfaces," Bd. 3, and Bianchi, "Lezioni di geometria differenziale").—A short note follows on the functions of the form $f(x) \equiv \phi(x) + a^1x^{n-1} + a_2x^{n-2} + \ldots + a_n$ which in a given interval differ the least possible from zero, by H. F. Blichfeldt. This gives Tchebycheff's solution (from Bertrand, "Calcul differentiel," p. 512) and then the author's solution. As this gentleman has not had access to Tchebycheff's memoirs his method may not be altogether novel.

Annalen der Physik, March.—On the production and measurement of sinoidal currents, by Max Wien. The ideal electrical oscillations for use in wireless telegraphy would consist of a continuous, purely sinoidal current, the oscillation frequency of which could be varied slowly and continuously from a low figure up to frequencies that could be seen. The arrangement described in the present paper, although still far short of this, constitutes a considerable advance upon previous work, as a purely sinoidal current can be obtained with an oscillation frequency up to 8500 per second, and with a slight depar-

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ture from the sine form, up to 17,000. The methods and special instruments for the exact measurement of these currents are also given.—The acoustical and electrical properties of the telephone, by Max Wien.—On the theory of rain precipitation in mountains, by F. Pockels. The conclusion is drawn from theoretical considerations that on the slope of a mountain chain there exists a zone of maximum precipitation, and that the inclination as well as the absolute height has an effect upon the amount precipitated. Both these conclusions are in agreement with observations upon the higher mountains.—The effect of current fluctuation, of electrical oscillations, and of an induced current upon a magnetic needle placed in a constant field, or upon a small soft iron inductor, by Max Hornemann.—Some results of capillarity phenomena, by A. Einstein.—On the so-called liquid crystals, by G. Tammann. It is shown that the effects produced by the so-called liquid crystals may be explained by the assumption that there is really present a mechanical mixture of two liquids. A partial separation was effected in the case of *p*-azoxyanisol.—On some experiments with the Becquerel and Röntgen rays, by F. Himstedt. The sparking distance for an influence machine is affected by both the radium rays and the Röntgen rays. The failure of Elster and Geitel to observe the latter effect is attributed by the author to the use of too small a Crookes' tube.—On the action of the Becquerel and Röntgen rays on the eye, by F. Himstedt and W. A. Nagel.—On the law of the distribution of energy in the spectrum, by Max Planck.—On the elementary quantity of matter and of electricity, by Max Planck.—Studies in hardness, by W. Voigt.—On characteristic curves in the electrical discharge through rarefied gases, by E. Riecke.—Experimental researches on the metallic reflection of electrical oscillations, by Karl F. Lindman.—On the distribution of electricity on an ellipsoid, by H. Dörrie.—On the transparency of hydrogen to light, by V. Schumann.—On the fundamental hypothesis of the kinetic theory of gases, by S. H. Burbury.—Remarks on the paper of E. v. Schweidler on the behaviour of liquid dielectrics on the passage of an electric current, by E. Warburg.

SOCIETIES AND ACADEMIES.

LONDON.

Physical Society.—Meeting held in University College, March 22.—Prof. S. P. Thompson, president, in the chair.—A paper on the expansion of silica was read by Prof. Callendar. The extreme smallness of the thermal expansion of silica (fused quartz) renders the determination of its coefficient of expansion more difficult than is the case with many substances. The author has made experiments upon a rod of pure silica 40 cms. long and 1 mm. diameter. This rod was enclosed in a platinum tube about 3 mms. diameter, which could be raised to various temperatures by the passage of a suitable electric current. Both the rod and the tube were firmly fixed at one end, and the positions of the other ends were accurately observed by a micrometer microscope reading to a thousandth of a mm. The expansion of the tube, in conjunction with a knowledge of its coefficient of expansion, served as a means of determining the temperature of the tube, and, therefore, of the rod. The increase in length, the original length and the range of temperature of the silica being known, the coefficient of expansion can be at once calculated. In some previous experiments the author has investigated the distribution of temperature along a heated platinum rod subjected to cooling at the ends. These experiments prove that the error due to end effect, in the case of the silica rod, can be neglected. The expansion of silica up to 1000° C. is regular, and is about one-seventeenth that of platinum. Between 1000° C. and 1400° C. silica expands more quickly than below 1000° C., and if left at any temperature for a considerable time continues to slowly increase in length. If a curve be plotted having temperatures as abscissæ, and increases in length as ordinates, a straight line will represent the expansion of silica up to 1000° C. Above 1000° C. the curve bends upwards, and upon cooling it returns along a path above the ascending curve, so that the final length of the bar is greater than the original length when the lower temperature is reached. The determination of the coefficient of expansion at these high temperatures was made by means of a variable zero, that is by using for the length of the rod that obtained by suddenly cooling from the higher to the lower temperature. At 1400° C. the properties of silica alter and the expansion is replaced by a contraction. On cooling from above 1400° C. to ordinary temperatures there is first an expansion and then a contraction. This property was illustrated by Prof. Callendar, the small changes in length of the rod being magnified by a lever and shown upon a screen by an optical arrangement. The critical point at which contraction occurs on heating has been found by Le Chetalier at about 800° C. His experiments were made by a differential method, using porcelain as a standard substance. As the expansion of porcelain is uncertain, the author thinks it probable that the effect noticed may be due to irregularities in the expansion of porcelain rather than in that of silica. Mr. Boys expressed his interest in the experiments and asked if the small coefficient of expansion of slate had ever been measured. The small expansion of silica would make it a useful suspension for pendulums on account of the small compensation necessary. Its perfect elastic properties might be made use of in hair springs for chronometers. Prof. Threlfall said that he had tried to measure the expansion of silica between 0° C. and 70° C. by weighing rods in distilled water, but the method was not accurate. He had made experiments similar in principle to the author's, using temperatures from 0° C. to 100° C. The devitrification of silica is troublesome, and he thought that the rate of devitrification in presence of air increased with the temperature. Dr. Donnan thought that the irregularities in the expansion of silica pointed to a complex composition. Mr. Porter (Eton) asked if the effect of fused quartz on polarised light had been investigated, and if this effect altered after heating to 1400° C. Mr. Boys said that quartz rods formed by fusion depolarised light. The chairman said that he had noticed the effect spoken of by Mr. Boys, due to strain, but he had been unable to detect any rotatory power. Prof. Callendar, in reply to Mr. Lupton, said that the expansion of quartz crystals was much larger than that of fused silica.—The spectroscopic apparatus of University College was then exhibited by Dr. Baly.—The Society then adjourned until April 26.

Chemical Society, March 7.—Dr. Perkin, vice-president, in the chair.—The following papers were read:—Nomenclature of the acid esters of unsymmetrical dicarboxylic acids, by J. J. Sudborough.—Additive compounds of α- and β-naphthylamine with trinitrobenzene derivatives, by J. J. Sudborough. The author describes a number of additive compounds of red or purple colour which are formed from derivatives of trinitrobenzene and the naphthylamines, and are more stable than such compounds as those of trinitrobenzene and aniline.—Acetylation of arylamines, by J. J. Sudborough. It is shown that the presence of ortho-substituents, whether of positive or negative character, accelerates the formation of diacetyl derivatives of primary arylamines.—Formation of amides from aldehydes, by R. H. Pickard and W. Carter. On oxidising an aldehyde with ammonium persulphate in presence of lime, a 30 to 40 per cent. yield of the amide of the corresponding acid is obtained.—A method of isolating maltose when mixed with glucose, by A. C. Hill. The author gives a method for separating maltose from a mixture of glucose and maltose based upon the fact that *Saccharomyces marxianus* destroys the former, but leaves the maltose untouched during its growth in a solution of the mixed sugars.—The vapour pressure of aqueous ammonia solutions, by E. P. Perman. The author has determined the vapour pressures of aqueous ammonia solutions between the temperatures 0° and 60°, and for concentrations up to 35 per cent.—The influence of sodium sulphate on the vapour pressure of aqueous ammonia solution, by E. P. Perman. The vapour pressure curves of aqueous ammonia containing sodium sulphate afford no indication that the latter exists as a hydrate in the solution.—Formation of aromatic compounds from ethyl glutaconate and its derivatives. The reduction of trimesic acid and the conversion of tetrahydrotrimesic acid into tetrahydroisophthalic acid, by W. T. Lawrence and W. H. Perkin, jun. Ethyl sodiodicarboxyglutaconate, $(COOEt)_2CNa.CH : C(COOEt)_2$, heated with alcohol at 150°, yields ethyl trimesate, and ethyl glutaconate, under similar conditions, is converted into a substance which on hydrolysis gives hydroxyisophthalic acid. Trimesic acid is reduced by sodium amalgam to a mixture of stereoisomeric tetrahydrotrimesic acids, of which one has been isolated in a pure state; this gives a double anhydride with acetic anhydride, which, when distilled, yields tetrahydroisophthalic anhydride.—Optical activity of certain ethers and esters, by P. A. Guye.—Halogen-substituted thiosinamines, by A. E. Dixon. The author describes a number of chloroallylthiocarbimides.—A form of tautomerism occurring amongst the thiocyanates of electro-negative radicles, by A. E. Dixon.

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